

American Occupational Therapy Foundation

Behavioral Health and Performance Element

Tools & Technologies

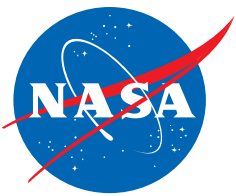


Human Research Program
Space Medicine Division
NASA Johnson Space Center

April 24, 2009

Lauren B. Leveton, Ph.D.

Element Manager

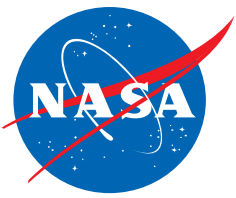


Overview

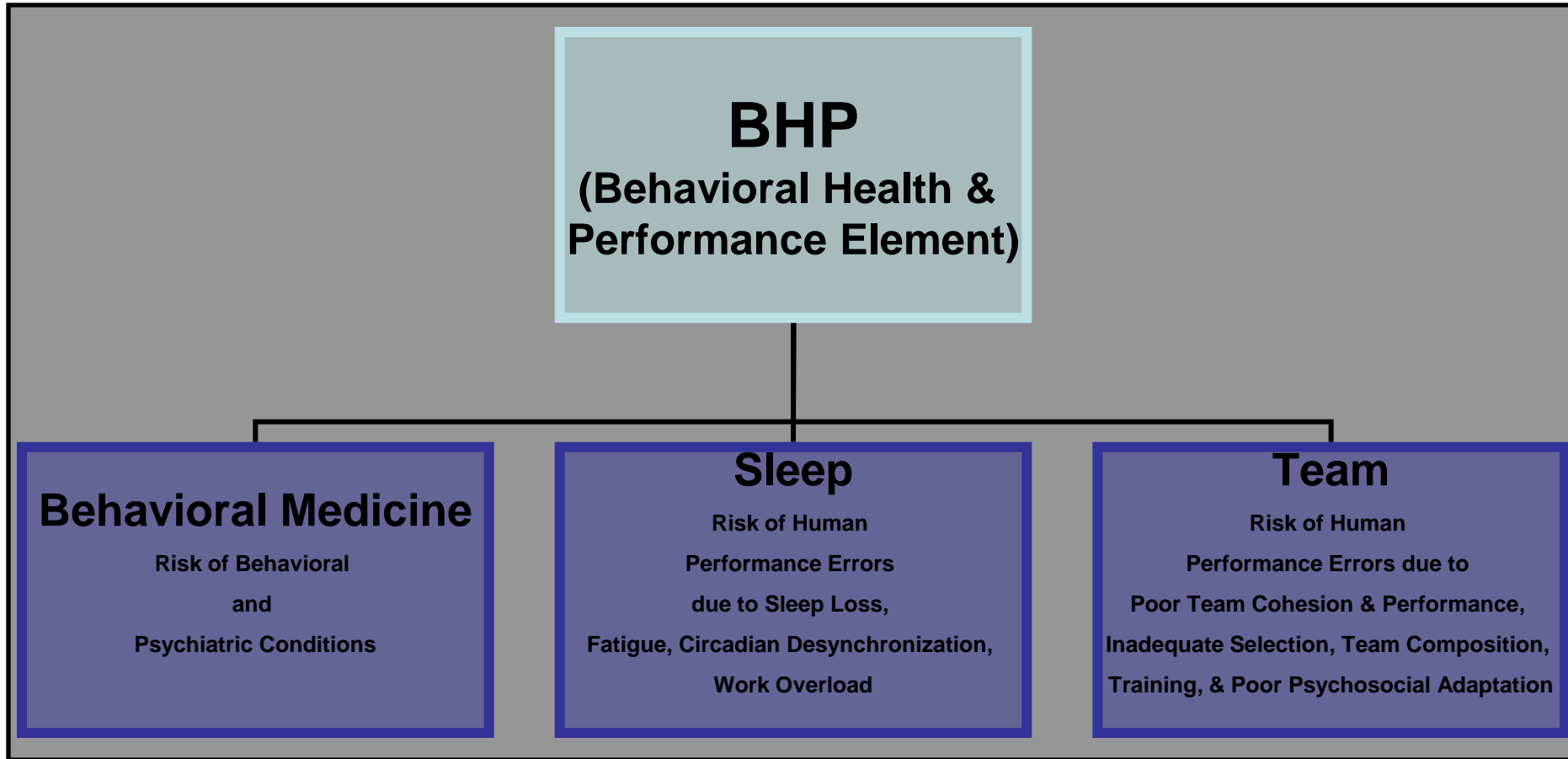
Human Research Program

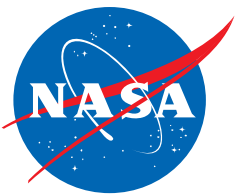
- **Background of BHP**
- **Current BHP Ops Practices**
- **Impact of Long Duration Missions**
- **How BHP Bridges Gap**





- **NASA**
 - Human Research Program
 - 6 Elements





Behavioral Health & Performance

Human Research Program

- **Program Element Goal:**

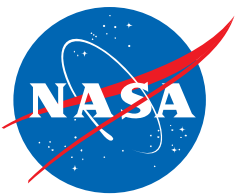
- Identify, characterize, and prevent or reduce behavioral health and performance risks associated with space travel, exploration and return to terrestrial life

- **BHP Strategy:**

- Highly focused, applied research strategy designed to yield deliverables that reduce risk

BHP Deliverables inform:

- Medical and Mission operations for Constellation Missions: Lunar Short, Lunar Long, and/or Mars
- Current ISS Operations



Behavioral Health & Performance

Human Research Program

BHP Requirements for Each Risk (B-Med, Team, Sleep):

- Develop and Validate Standards
- Quantify Risks

Requirements Include:

- BHP shall develop Countermeasures and Technologies to prevent or mitigate adverse outcomes of human health and performance risks
- BHP shall develop Countermeasures and Technologies to monitor and treat adverse outcomes of human health and performance

To accomplish the above, BHP Research collaborates with Ops
(this presentation is focused on the Tools/Technologies)

As Ops views Research



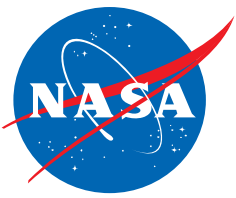
Donning his new canine decoder, Professor Schwartzman becomes the first human being on Earth to hear what barking dogs are actually saying.

© Cartoonbank.com



"It's fine to discover cures, but, remember, chronic conditions are our bread and butter."

And as,
Research views Ops



What BHP Ops is Currently Doing...

Human Research Program

- **Training (pre-flight)**

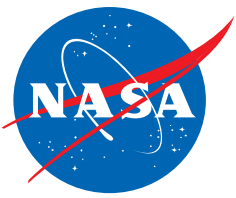
- Self care
- Psychological factors of long duration mission (LDM)
- Psychological support (services available)
- Practical planning for LDM
- Conflict management
- Cross-cultural
- Behavioral medicine training



- **Support Services (pre-flight, in-flight, and post-flight)**

- Counseling
 - Astronauts, spouses, and children
- Psychological Support
 - Care Packages, 100-Day Party, Birthday Parties, Celebrity Appearances, etc.

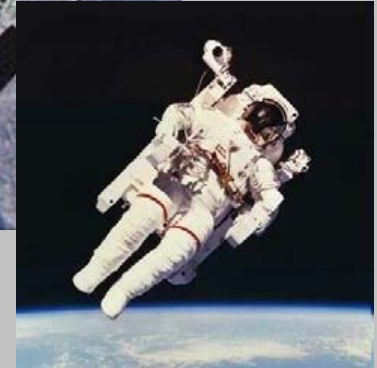




What BHP Ops is Currently Doing...

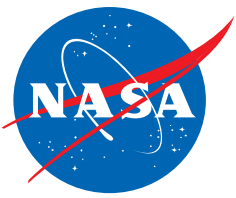
Human Research Program

- **Med Kit (in-flight)**
 - Emergency situations



- **WinSCAT**
 - Neuro-psychological assessment (TBI: traumatic brain injury/toxic exposure)

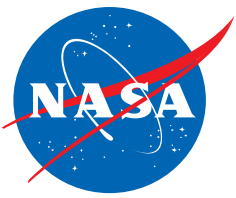




LDM Presents New Challenges...

Human Research Program

- **Long Duration Missions (LDM) will present new challenges:**
 - **Lunar and Mars missions will require long duration stays in remote, isolated, and unique environments, with extended periods of heavy workload**
 - **Day and night cycles will differ from standard Earth time**
 - **Teams composed of only a few individuals will experience prolonged confinement as well as times of monotony**
 - **Also have to deal with issues concerning communication, sleep, and autonomy**



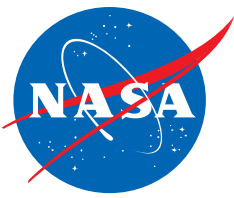
LDM Presents New Challenges...

Human Research Program

| Risks that will be Affected by LDM | | |
|------------------------------------|--------------|------------|
| | Lunar Sortie | Lunar Long |
| Sleep Risk | X | X |
| BMed Risk | | X |
| Team Risk | X | X |

**New LDM Challenges Create a Need for new BHP Tools,
Technologies and Services**

- BHP deliverables will yield technologies and methods to aid the behavioral health and performance of astronaut crews, during and following these exploration missions



BHP Research will Bridge Gap...

Human Research Program

Need for New Technologies/Tools by Risk

Behavioral Medicine

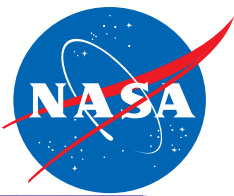
- **Monitoring & Self-Assessment Tools for living and working in space. These will provide early detection and treatment using unobtrusive and objective measures of:**
 - Affect
 - Fatigue
 - Stress Reactions

Team

- **Tools and technologies to unobtrusively monitor:**
 - Team Performance,
 - Team Cohesion
 - Crew-ground interactions
- **These will ensure optimal crew performance**

Sleep

- **Countermeasure tool development for:**
 - Fatigue
 - Lighting
 - Medications
 - Sleep Hygiene
 - Work/Rest Schedules



BHP Research will Bridge Gap...

Human Research Program

Current Tool Development (NRA, NSBRI, DR, & SBIR)

Behavioral Medicine

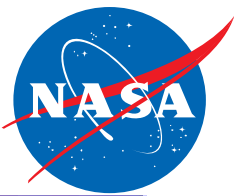
- Virtual Space Station (doc in a box) NSBRI
 - Depression
- Facial Monitoring Technology
 - Stress/Affect/Fatigue
- Near-Infrared Neuro-Imaging
 - Depression
- Cognitive Assessment Tool
 - Multi-faceted (SBIR)
- Multi-Media Self-Help Software
 - Stress/Anxiety

Team

- Virtual Space Station (doc in a box) NSBRI
 - Conflict Management
- Crew Cohesion Monitoring Tool
- Crew Performance Monitoring Tool
- Autonomy Assessment Tool
 - Crew cohesion/performance
- SpiFE (work/rest schedules)
 - Autonomy

Sleep

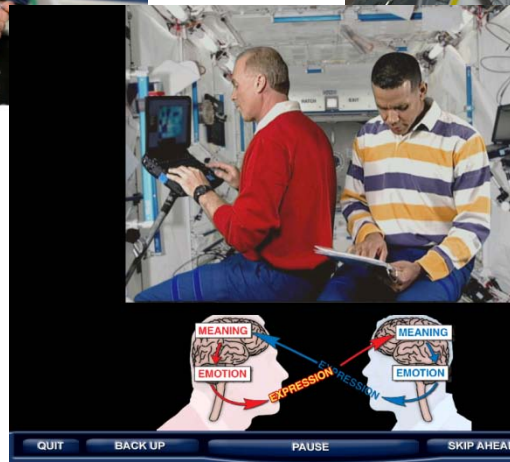
- PVT Self-Test
 - Fatigue
- Cog Assessment Tool
 - Multi-faceted (SBIR)
- Individualized Fatigue Meter
 - Fatigue
- Circadian Modeling Software
 - Work/Rest Schedules
- Actiwatch
 - Lighting/Fatigue
- Sleep/Wake Database
 - Medications
- SpiFE
 - Work/Rest Schedules

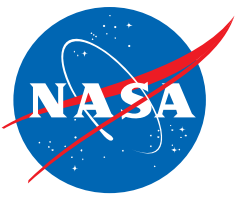


BHP Research will Bridge Gap...

Human Research Program

Current Tool Development (NRA, NSBRI, DR, & SBIR)





BHP Research will Bridge Gap...

Human Research Program

Continued Tool/Technology Needs:

Behavioral Medicine

- Unobtrusive technologies to detect and assess decrements in behavioral health which may negatively affect performance during LDM
- Example:
 - Voice Acoustics Monitoring Technology (stress)

Team

- Unobtrusive technologies to:
 - Monitor and measure crew-ground interaction
 - Train crews utilizing software-based training modules for team dynamics
 - Cohesion
 - Interpersonal Conflict
 - Performance
 - Crew-Ground Interaction
 - Communication
 - Autonomy

Sleep

- Unobtrusive technologies to:
 - Assess decrements in motor performance
 - Integrate medical models that address fatigue, sleep, and work/rest schedules
- Example:
 - Motor Performance Dual Task Test

